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be $\frac{13-5c^2}{8c}$. Hence $26c-10c^3$ must be a square; it is evident that this is the case when $c=1$. Then $b=1$ and $a=\frac{9}{4}$. Substituting these in the values of m and n , and we have $m=\frac{41}{9}$ and $n=\frac{85}{9}$. Taking $x=153$, we have $mx=697$, and $nx=185$, and the numbers are $(153)^2$, $(185)^2$, and $(697)^2$.

Also solved by *G. B. M. ZERR*, and *EDWARD D. GRABER*.

AVERAGE AND PROBABILITY.

111. Proposed by *LON C. WALKER, A.M.*, Professor of Mathematics, Petaluma High School, Petaluma, Cal.

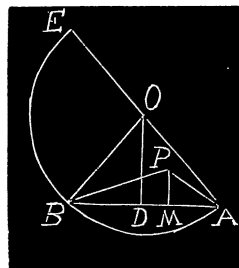
If a radius be drawn at random in a given semi-circle, and a point taken at random in one of the sectors formed, show that the chance that a random line drawn through the point will cut the arc of the sector is $1 - \frac{1}{\pi^2} \log 2$.

Solution by the PROPOSER.

Let ABE be the given semicircle, OB the random radius, P the random point, OD and PM perpendicular to AB .

Put $DM=x$, $PM=y$, $OA=1$, $\angle AOB=\theta$, $\angle APM=\phi$, $\angle BPM=\psi$. Then $AD=\sin\frac{1}{2}\theta$, $OD=\cos\frac{1}{2}\theta$, area of segment $ACB=\frac{1}{2}(\theta-\sin\theta)$, $\phi=\tan^{-1}\left(\frac{\sin\frac{1}{2}\theta-x}{y}\right)$, $\psi=\tan^{-1}\left(\frac{\sin\frac{1}{2}\theta+x}{y}\right)$

When P is in the segment ACB the random line will cut the arc whatever be its direction, and when P is in the triangle AOB the number of favorable directions of the random line will be $2(\phi+\psi)$. Hence we have



$$\begin{aligned}
 p &= \frac{\int_0^\pi \pi(\theta - \sin\theta) d\theta + \int_0^\pi \int_0^{\cos\frac{1}{2}\theta} \int_{-\tan\frac{1}{2}\theta(\cos\frac{1}{2}\theta-y)}^{\tan\frac{1}{2}\theta(\cos\frac{1}{2}\theta-y)} 2(\phi+\psi) dx dy d\theta}{\int_0^\pi \pi\theta d\theta} \\
 &= 1 - \frac{4}{\pi^2} + \frac{4}{\pi^3} \int_0^\pi \int_0^{\cos\frac{1}{2}\theta} \left[2\tan\frac{1}{2}\theta(2\cos\frac{1}{2}\theta-y) \tan^{-1}\tan\frac{1}{2}\theta \left(\frac{2\cos\frac{1}{2}\theta-y}{y} \right) \right. \\
 &\quad \left. - y\theta \tan\frac{1}{2}\theta - y \log \left(\frac{y^2 + \tan^2\frac{1}{2}\theta(2\cos\frac{1}{2}\theta-y)^2}{2y^2} \right) \right] dy d\theta \\
 &= 1 - \frac{4}{\pi^2} + \frac{4}{\pi^3} \int_0^\pi \left[\theta \sin\frac{1}{2}\theta \cos\frac{1}{2}\theta - 2(\theta - \pi) \sin^3\frac{1}{2}\theta \cos\frac{1}{2}\theta - 2\sin^2\frac{1}{2}\theta \cos^2\frac{1}{2}\theta \log^2 \right. \\
 &\quad \left. + \frac{1}{4} \log \left(\frac{1+\cos\theta}{1-\cos\theta} \right) + \frac{1}{4} \cos\theta \log(1+\cos\theta) + \frac{1}{2} \cos 2\theta \log(1-\cos\theta) \right] d\theta = 1 - \frac{1}{\pi^2} \log 2.
 \end{aligned}$$

Solved with same result by *F. P. MATZ*. Professor Zerr gets as a result $1 - (1/4\pi^2)(8\log 2 + 7)$.